

TECHNICAL SPECIFICATION

FOR

**AVIATION COMBINED ARMS TACTICAL TRAINER
(AVCATT)**

HELMET MOUNTED DISPLAY (HMD)

TECHNOLOGY REFRESH

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1. OPTICAL

1.1. Field of View (FOV)

The instantaneous field of view (IFOV) of the HMD shall be a minimum rectangle of 100 degrees horizontal and 50 degrees vertical with a minimum 30 degree overlap (binocular vision area). The field-of-view specified is the active display area visible from the design eye point.

1.2. Eye Relief

The eye relief shall be equal to or greater than 30 millimeters to accommodate eyeglasses.

1.3. Exit Pupil

The exit pupil (if a pupil forming system) shall be equal to or greater than 15 millimeters.

1.4. Interpupillary Distance

Interpupillary Distance (IPD) range shall meet 5th to 95th percentile Male/Female Adult

1.5. Transmissivity

The HMD design shall include a minimum 50% percent or better light transmission through the combiner optics. The design shall allow the readability of the instrument panels through the HMD.

1.6. HMD Optical Design

- No chromatic aberration shall be discernible.
- There shall be no spurious images or reflections including light leaks, mirror imperfections, or from any other source.
- The observed image distance shall be 30 feet or greater.
- Divergence of the left and right monocular shall be no greater than 10 arc minutes.

2. DISPLAYED IMAGE

2.1. Resolution

The HMD shall display full-color imagery provided by the image generator. ~~The HMD native minimum resolution shall be a 1280 x 1024 (SXGA).~~ The desire is to have a higher resolution HMD. Please suggest resolutions that will be in your products that could meet this spec in 2017.

2.2. Vertical Rate

The vertical rate shall be at a minimum 60 Hz.

2.3. Image Clarity

2.3.1. Image Latency or Smear

The displayed image shall not smear or blur when the pilot turns his head.

2.3.2. Brightness

Luminance will be at least 20 foot lamberts (peak white). The variance in luminance between left and right monocular shall be less than 10%. (The desired white color temperature is 6500K- natural daylight)

2.3.3. Contrast

The contrast (White Field / Black Field) shall be greater than or equal to 150:1 (min).

The contrast (Checkerboard) shall be greater than or equal to 20:1 (min)

3. MECHANICAL

3.1. Weight

The total weight of the HMD including displays, tracker, and cable, excluding only the helmet, shall not exceed 2.5 lbs (1.5 lb is desired). The weight shall be determined by the optics, tracker, and cables attached to the HMD. The weight shall be determined by placing the HMD on a scale with the cables resting on a platform 1 foot distance away from the HMD. The cable platform shall be at the same elevation as the scale platform.

3.2. Center of Mass

The HMD center of mass shall be located within 15% of the head's center of mass.

3.3. Mounting Time

Initial mounting of the HMD to the helmet shall require no more than 5 minutes.

Fit and Adjustment

The optics shall have an interpupillary adjustment mechanism. Initial optical alignment required to adjust and fit the HMD to a user shall require no more than 10 minutes. Follow on optical alignments shall take no longer than 5 minutes.

The desire is to simplify the procedure as much as possible.

3.4. Ruggedization

The design shall be ruggedized for use in a training environment. The mechanical design of the HMD shall be improved to afford protection of fragile and alignment critical components during normal use to insure device availability requirements are achieved. The design shall address the following current issues:

- The HMD shall be able to withstand impacts and drops from a 2 feet elevation with no or easily repairable damage.

- Easy to repair by Contractor Logistics Support (CLS) with onsite tools.
- Minimized logistic footprint.

This is an area that the Government desires improvement in. What requirements or tests do you recommend to ensure that the devices do not incur costly repairs during the lifecycle?

3.5. Footprint

The contractor shall develop an HMD with a volumetric footprint that is equal or less than 10" Length x 17" Wide x 6.5" Height.

3.6. Cabling

There shall be no more than 2 cables attached to the HMD. The cables are desired to be exiting from the back of the helmet. The cables should have sufficient bandwidth so as not to introduce latency. The cables shall be sufficiently shielded to prevent mechanical or electrical introduced interference. The cables shall be flexible and light so as not to impede crewmember head motions.

4. Head Tracker

4.1. Head Tracker

The head tracker system provides HMD position and orientation. The AVCATT program is currently using the Intersense IS-900 Sim Tracker. The head tracker has 6 Degrees of Freedom (X, Y, Z, Yaw, Pitch, and Roll) of motion capability.

4.2. Head Tracker Station Integrated with HMD

The head tracker station(s) or sensor(s) shall be integrated with the HMD. The tracked station device(s) shall output an X, Y, Z position along with pitch, Yaw, and roll information. The integrated head tracker stations(s) shall provide tracking that is jitter-free, drift-free, and distortion-free. The head tracker shall provide head position motion prediction to minimize latency between the displayed scene and head movement. Latency from head movement shall not be noticeable, thus avoiding induced simulator sickness. The head tracker shall meet current AVCATT Operational Specifications:

4.3. Tracking Device(s)

Degrees of Freedom: 6 (X, Y, Z, Yaw, Pitch, and Roll)
 Angular Range: Full 360° - All Axes
 Update Rate: 180 Hz Nominal (120 Hz Nominal Wireless)
 Latency: 4 ms Typical

4.4. Maximum Resolution

Position (X/Y/Z): 0.75 mm
 Angular (P/R/Y): 0.05°

4.5. Maximum Static Accuracy

Position: 2.0 to 3.0 mm

Angular: 0.25° RMS in Pitch & Roll, 0.50° RMS in Yaw

5. Helmet

The helmet shall implement a mounting system that will allow the HMD to be mounted on a light weight head mount, a vendor provided hard shell helmet (AVCATT Helmet) or the pilots own helmets.

5.1. Light Weight Head Mount

The light weight head mount shall be adjustable to provide a firm fit. The head mount shall not slip when the HMD is mounted and the head is moved quickly through all axes, including when the head is lowered and turned quickly left to right. The head mount shall provide a good fit for persons with smaller heads and also to persons with shallow indentions at the transition between the back of their neck and the base of their skull. The head mount solution shall be less than or equal to 1.5 lb total weight, not including HMD.

5.2. AVCATT Helmets or Similar Hard Shell Helmets

The hard shell helmet shall at the least support the same functionality as the current AVCATT Helmet. The hard shell design shall weigh equal to or less than 2.85 lbs, not including the HMD. The mounting system shall provide a firm fit with no slippage when the helmet has the HMD mounted and the head is moved quickly through all axes including when the head is lowered and the head turned quickly left to right.

5.3. Pilot Helmets

The HMD mounting design shall allow for the use of the pilots own helmet (HGU-55P and HGU-56P). This shall be implemented by the ANVIS mount. Any implementation shall provide a way to provide 3D Audio Cueing and tactical communications.

5.4. Audio

The contractor shall provide 3D audio cues for the simulation through the helmet or a device that can be worn under the helmet.

5.5. Communication

The contractor shall support the tactical communication requirements in the AVCATT trainer.